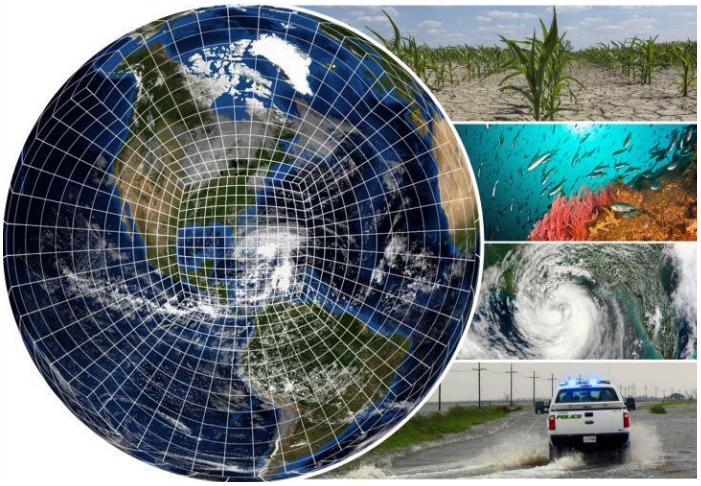
Modeling, Analysis, Predictions and Projections Program and CPO's Climate Risk Areas

The MAPP program has funded research in the areas of coastal inundation, marine ecosystems, water resources and extreme heat for years. These four climate risk areas are part of a new CPO initiative.

Communities across the country are faced with multiple impacts of a changing climate, such as increased flooding and drought variability, warmer and more-variable ocean temperatures, altered precipitation patterns and more-frequent heat waves.

The Climate Program Office (CPO) in 2019 identified four areas of climate risks around which CPO's research and communications divisions could collectively focus. CPO is piloting this strategic effort to address America's most pressing climate challenges by applying science to improve capabilities and support user-driven needs.



MAPP plays a vital role in meeting the societal challenges created by climate variability, change, and impacts relevant to the CPO risk areas.

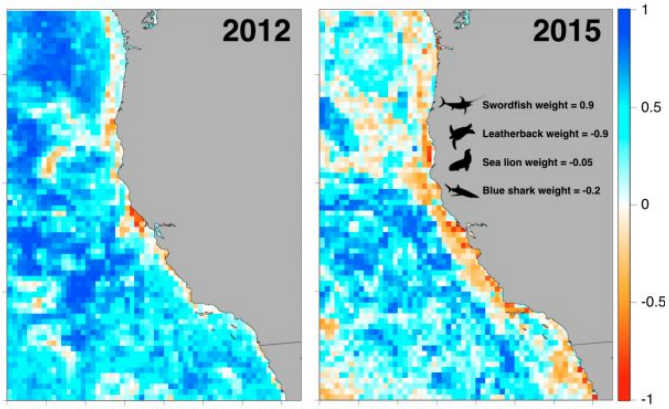
MAPP invests in research to **advance climate and Earth system modeling** to simulate climate variability and climate change that undergird our understanding of changes in the climate system. MAPP's investments target the research space at the transition between fundamental climate process research and applications.

Working with partners, **MAPP supports research on climate variability and change, prediction, monitoring, and modeling targeting issues such as drought, extreme heat, flooding, and changing sea levels**. Many of MAPP's recent funding efforts aligned closely with the four CPO risk areas and laid groundwork for R&D supporting these risk areas.

How does MAPP science support the CPO climate risk areas?

1. Coastal Inundation

- In FY17, MAPP funded two research projects to explore **seasonal prediction of coastal high water levels** that result from seasonal variations in climate modes such as the El Niño–Southern Oscillation, regional dynamics such as the Gulf Stream, and tidal phases in combination with longer-term climate trends.
- These projects collaborated and coordinated as part of the Marine Prediction Task Force to optimize outcomes toward the development of **enhanced coastal flooding predictions**.



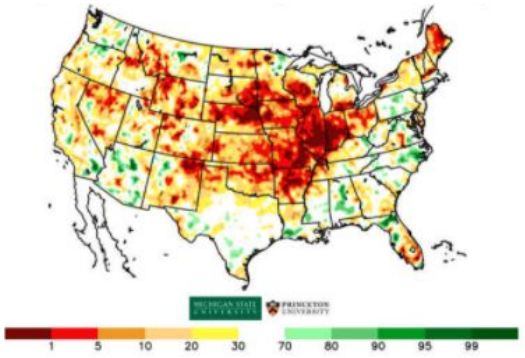
Maps depicting model output of catch and bycatch species distribution of favorable (blue) vs. unfavorable (red) fishing grounds

2. Marine Ecosystems

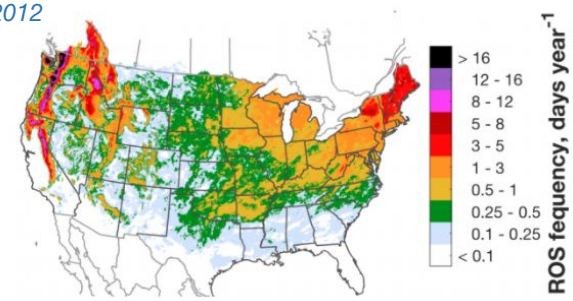
- In partnership with NOAA's Fisheries Service, MAPP has funded two large sets of projects (in FY17 and FY20) focused on prediction and modeling of marine ecosystems.
- The focus of the FY17-20 projects has been to develop seasonal forecasting capabilities for fisheries and other marine living resources with a regional focus on the U.S. West Coast, Northeast U.S. Shelf and Eastern Bering Sea.
- FY20-23 projects focus on regional modeling and climate forecasts, numerical representation of biogeochemistry, quantification of the biophysical links between ecosystems and climate forcing drivers. MAPP has organized Task Forces to lead and create collaboration between the research projects.

3. Water Resources

- MAPP has a long and persistent record of supporting drought research in **partnership with NIDIS**. Since 2011, four consecutive Drought Task Forces were funded and organized by NIDIS and MAPP; the latest commenced in 2020. The Drought Task Force was established to achieve significant new advances in the ability to understand, monitor and predict drought over North America. An integrated drought prediction system has been developed with the support of numerous research projects. Capabilities developed from these research projects **inform water resource management** across the country.
- MAPP has also funded work that uses the Coupled Model Intercomparison Project data to produce integrated climate projections and develop model diagnostics. Projection projects are focused on a wide range of water-resource issues including **seasonal snow cover, western hydro-climate, rain-on-snow flooding events, and flooding and extremes driven by mid-latitude synoptic weather patterns**. Diagnostic activities are focused on benchmarking model deficiencies related to the movement of water throughout the atmosphere, precipitation patterns and behavior, and land surface-atmosphere interactions.



Model-based daily soil moisture percentile on July 31, 2012



Averaged annual Rain-On-Snow frequency from NOAA SNODAS product. Shown are days (10/1/2003-9/30/2018) with heavy rainfall ≥10mm and snow water equivalent ≥10mm

4. Extreme Heat

- MAPP has funded a series of projects over the past decade focused on extreme heat. The North American Multi-Model Ensemble (NMME) prediction system has been leveraged to extend the prediction skill of the **subseasonal excessive heat outlook system** with a focus on human health.
- Projects have been funded focused on Subseasonal to Seasonal (S2S) variability of heat events, S2S predictions of heat waves, and predictability of drivers of heat waves.
- Efforts to understand the linkages between drought and heat waves and **compound extremes** (where different extremes may challenge societal resilience in parallel or sequence).

5. Cross-Risk Area Efforts

- High-performing climate models are needed to **provide useful climate information across all risk areas**. MAPP supports the development of climate models and their application to understanding and projecting climate risks.
- Monitoring of the physical climate system undergirds our understanding and early warning of **emerging threats**. MAPP supports model-based analysis and research projects leveraging climate data and modeling capabilities.
- MAPP is co-supporting an effort to **explain extreme events** in a climate context with CPO's Climate Variability and Predictability, Climate Observations and Monitoring, and Assessments programs.